CLAIMS

1. A connector for use in making an insulating composite wall structure, the connector comprising a body having a penetrating segment configured to reside within a first structural layer, a trailing segment configured to reside within a second structural layer, and a mesial segment between the penetration and trailing segments configured to reside within an insulating layer when the connector is in use, the body comprising:

two sidewalls that are spaced apart and that have a width or diameter;

a web portion extending between the two sidewalls, the web portion having a thickness that is less than the width or diameter of the sidewalls;

a tapered end configured to facilitate penetration of the connector through an insulating layer and a layer of unhardened structural material adjacent to the insulating layer;

orienting means for limiting penetration of the connector through an insulating layer at a predetermined depth; and

anchoring means for anchoring at least one of the penetrating and trailing segments within a corresponding layer of hardened structural material.

2. A connection as recited in claim 1, the sidewalls and the web portion having a substantially I-shaped cross section within the mesial segment.

3. A connector is recited in claim 1, the sidewalls being substantially parallel and the web portion being substantially perpendicular to the sidewalls.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

4. A connector is recited in claim 1, wherein the width or diameter of the sidewalls is at least 50% greater than the thickness of the web portion.

5. A connector is recited in claim 1, wherein the width or diameter of the sidewalls is at least twice the thickness of the web portion.

6. A connector is recited in claim 1, wherein the width or diameter of the sidewalls is at least three times the thickness of the web portion.

7. A connector as recited in claim 1, the orienting means comprising at least one protrusion extending away from the web portion at or near where the mesial and trailing segments intersect.

8. A connector as recited in claim 1, the body comprising at least one of a cured resinous material or a thermoplastic material.

9. A connector as recited in claim 8, the body further comprising fibers within the cured resinous or thermoplastic material.

10. A connector as recited in claim 1, the anchoring means comprising at least one of a recess, a hole, a ridge, a protrusion, a flange, a depression, a notch, an extension, or other irregularity disposed on or within the body.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

11. A connector as recited in claim 1, at least one of the sidewalls including an angled face at or near the tapered end.

12. A connector as recited in claim 1, at least one of the sidewalls terminating with a chisel-like edge at or near the vicinity of the tapered end.

13. A connector as recited in claim 1, the tapered end terminating with at least one substantially straight edge.

14. A connector as recited in claim 1, the tapered end terminating with at least one curved edge.

15. A connector as recited in claim 1, the tapered end terminating with a substantially sharp edge.

16. A connector as recited in claim 1, the tapered end terminating with a substantially blunt edge.

17. A connector as recited in claim 1, the tapered end terminating with a plurality of spaced-apart points or edges.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

18. A connector as recited in claim 1, the body further comprising a trailing wall extending at least partially between the sidewalls at an end of said body within the trailing segment.

19. A connector as recited in claim 1, further comprising one or more raised longitudinal ribs extending from at least one surface of the web portion.

20. A connector as recited in claim 1, the connector being sized and configured so as to provide from about 50% to about 100% composite action within an insulating composite wall structure.

21. A connector as recited in claim 1, the connector being sized and configured so as to provide at least about 60% composite action within an insulating composite wall structure.

22. A connector as recited in claim 1, the connector being sized and configured so as to provide at least about 70% composite action within an insulating composite wall structure.

23. A connector as recited in claim 1, the connector being sized and configured so as to provide at least about 80% composite action within an insulating composite wall structure.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

24. A connector as recited in claim 1, the connector being sized and configured so as to provide at least about 90% composite action within an insulating composite wall structure.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

25. A connector for use in making an insulating composite wall structure, the connector comprising a body having a penetrating segment configured to reside within a first structural layer, a trailing segment configured to reside within a second structural layer, and a mesial segment between the penetrating and trailing segments configured to reside within an insulating layer when the connector is in use, the body comprising:

two sidewalls that are spaced apart and that have a width or diameter;

a web portion extending between the two sidewalls, the web portion having a thickness that is less than the width or diameter of the sidewalls;

a tapered end configured to facilitate penetration of the connector through an insulating layer and a layer of unhardened structural material adjacent to the insulating layer, the tapered end comprising a single elongate edge;

at least one protrusion extending laterally from the web portion at or near where the mesial and trailing segments intersect;

at least one of a recess, hole, ridge, protrusion, flange, depression, notch, or extension within the penetrating segment; and

at least one of a recess, hole, ridge, protrusion, flange, depression, notch, or extension within the trailing segment.

26. A connector as recited in claim 25, the body further comprising a trailing wall extending at least partially between the sidewalls at an end of said body within the trailing segment.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

27. A connector for use in making an insulating composite wall structure, the connector comprising a body having a penetrating segment configured to reside within a first structural layer, a trailing segment configured to reside within a second structural layer, and a mesial segment between the penetration and trailing segments configured to reside within an insulating layer when the connector is in use, the body comprising:

two sidewalls that are spaced apart and that have a width or diameter;

a web portion extending between the two sidewalls, the web portion having a thickness that is less than the width or diameter of the sidewalls;

a tapered end comprising a plurality of spaced-apart edges or pointed tips configured to facilitate penetration of the connector through an insulating layer and a layer of unhardened structural material adjacent to the insulating layer;

at least one protrusion extending from the web portion or at least one of the sidewalls at or near where the mesial and trailing segments intersect; and

anchoring means for anchoring at least one of the penetrating and trailing segments within a corresponding layer of hardened structural material.

28. A connector as recited in claim 27, further comprising one or more raised longitudinal ribs extending from at least one surface of the web portion.

29. A connector as recited in claim 27, further comprising one or more recesses formed between the spaced-apart edges or pointed ends.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

30. A connector as recited in claim 27, the anchoring means comprising at least one of a recess, a hole, a ridge, a protrusion, a flange, a depression, a notch, an extension, or other irregularity disposed on or within the body.

31. A connector as recited in claim 27, the tapered end comprising at least three pointed tips.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

32. A method of manufacturing a composite wall structure, comprising:

providing at least one connector as recited in any one of claims 1, 25 or 27;

placing an insulating layer adjacent to a first layer of unhardened structural material;

inserting at least one connector through an exposed side of the insulating layer so that the mesial segment resides within the insulating layer and the penetrating segment resides within the first layer of unhardened structural material;

placing a second layer of unhardened structural material adjacent to the exposed side of the insulating layer in order for the trailing segment of the connector to reside within the second layer of unhardened structural material; and

allowing the first and second layers of unhardened structural material to harden.

33. A method as recited in claim 32, the first and second layers of unhardened structural material hardening substantially simultaneously.

34. A method as recited in claim 32, the first and second layers of unhardened structural material hardening sequentially.

35. A method as recited in claim 32, the insulating layer having a plurality of grooves formed thereon.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

36. A composite wall structure, comprising:

a first layer of structural material;

a second layer of structural material;

an insulating layer disposed between the first and second structural layers; and

at least one connector according to any one of claims 1, 25 or 27,

the penetrating segment of the connector being embedded within the first structural layer,

the trailing segment of the connector being embedded within the second structural layer, and

the mesial segment of the connector being disposed within the insulating layer.

37. A composite wall structure as recited in claim 36, the insulating layer having a plurality of grooves formed thereon.

38. A composite wall structure as recited in claim 36, the composite wall structure comprising a plurality of connectors having a composite action and being spaced apart so that the composite wall structure has a composite action in a range of about 15% to about 100%.

39. A composite wall structure as recited in claim 36, the composite wall structure comprising a plurality of connectors having a composite action and being

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

spaced apart so that the composite wall structure has a composite action of at least about 50%.

40. A composite wall structure as recited in claim 36, the composite wall structure comprising a plurality of connectors having a composite action and being spaced apart so that the composite wall structure has a composite action of at least about 60%.

41. A composite wall structure as recited in claim 36, the composite wall structure comprising a plurality of connectors having a composite action and being spaced apart so that the composite wall structure has a composite action of at least about 70%.

42. A composite wall structure as recited in claim 36, the composite wall structure comprising a plurality of connectors having a composite action and being spaced apart so that the composite wall structure has a composite action of at least about 80%.

43. A composite wall structure as recited in claim 36, the composite wall structure comprising a plurality of connectors having a composite action and being spaced apart so that the composite wall structure has a composite action of at least about 90%.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111